

Using Wind Power to Hedge Large End-Users' Electric Bills

Mark Bolinger

Lawrence Berkeley National Laboratory

MABolinger@lbl.gov (603.795.4937)

8th Annual Green Power Marketing Conference

Chicago, Illinois

November 3, 2003

Research Funded by NYSERDA

“Using Wind Power to Hedge Volatile Electricity Prices for Commercial and Industrial Customers in New York”

- by Mark Bolinger, Robert Grace, Douglas Smith, Ryan Wiser
(with Arthur Freitas and Michael Tennis)
- www.nyserdera.org/energyresources/WindHedgeFinalcomplete.pdf
- New York case study motivated by:
 - + Price volatility in NYISO electricity markets
 - + Limited green power activity in restructured NY market
 - + Scarcity of creditworthy wholesale wind buyers (2 of 3 existing commercial wind projects sell power into spot market)

- = Desire to investigate feasibility of retail product that addresses all three issues (i.e., reduces volatility, boosts green power market, supports wind projects)

Questions we asked...

- What are the advantages of a wind hedge, relative to conventional hedges?
- How would a retail wind hedge product be structured?
- Is there any experience with offering wind hedge products?
- What challenges face wind hedge products?
- How effective might a wind hedge be in NY?

Advantages of Retail Wind Hedge

- Longer-term hedge than typically available; long-term alternatives have high transaction costs
- Wind hedge may be less susceptible to credit risk or nonperformance concerns than conventional hedges
- A third revenue source for wind generator:
 - 1) Commodities (energy/capacity)
 - 2) Green attributes
 - 3) Hedge value**

Two Wind Hedge Product Structures

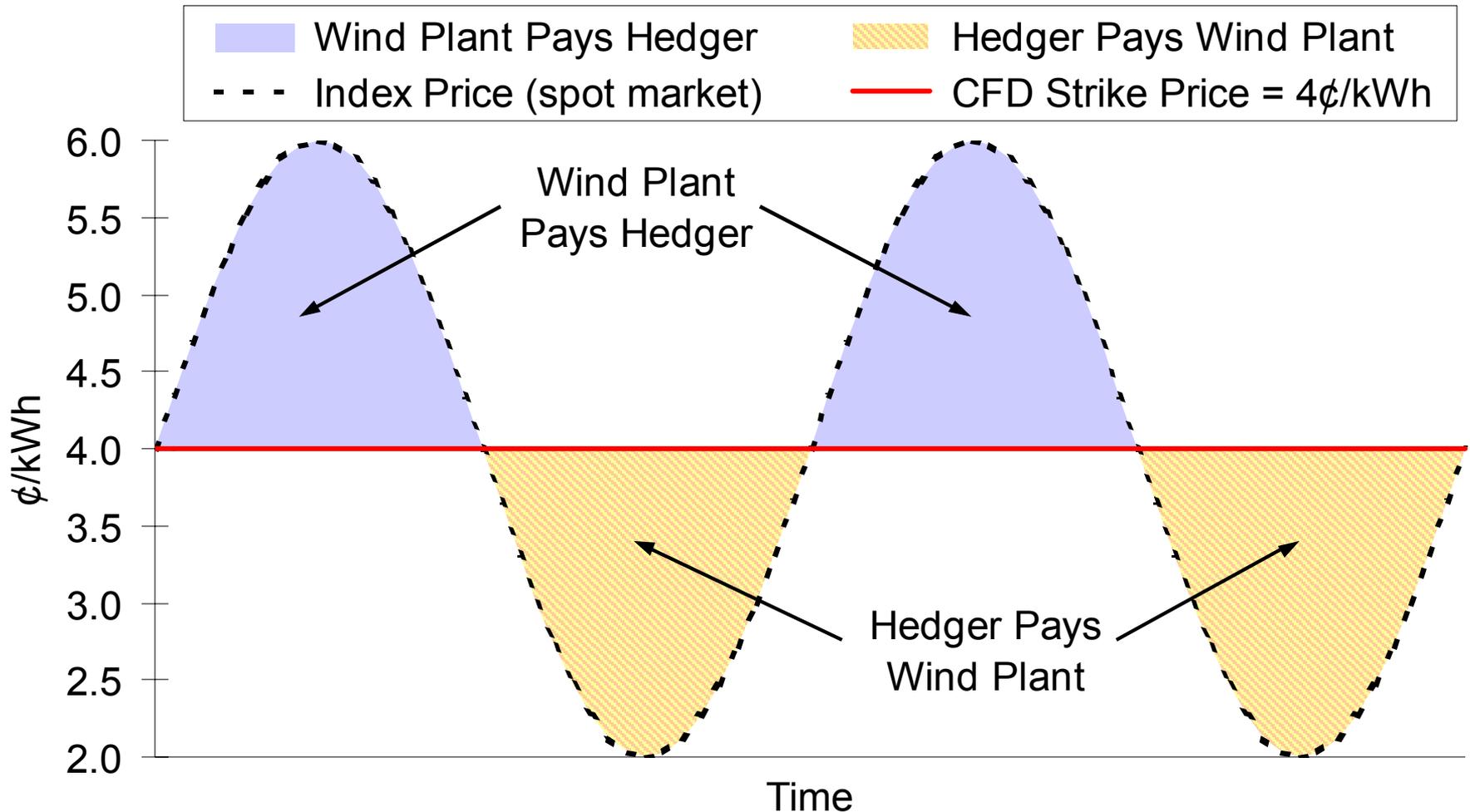
1) Bundled Electricity Service:

- **Fixed-price electricity** from utility or ESCO, who purchases wind power (with or without green attributes)

2) Financial Contract-for-Differences (CFD):

- **Floating-price electricity** from utility or ESCO, combined with financial **CFD** between wind plant and end-user
- Variable payments = difference between spot market index and negotiated “strike price”
- Perfect hedge for wind generator **if** it sells energy into spot market to which CFD is indexed
- Will never be perfect hedge for customer, because of varying load and production mismatch
- No need to switch providers

Structure of a Wind CFD



Industry Experience with Wind Hedges

Regulated Markets:

- see Lori Bird's presentation

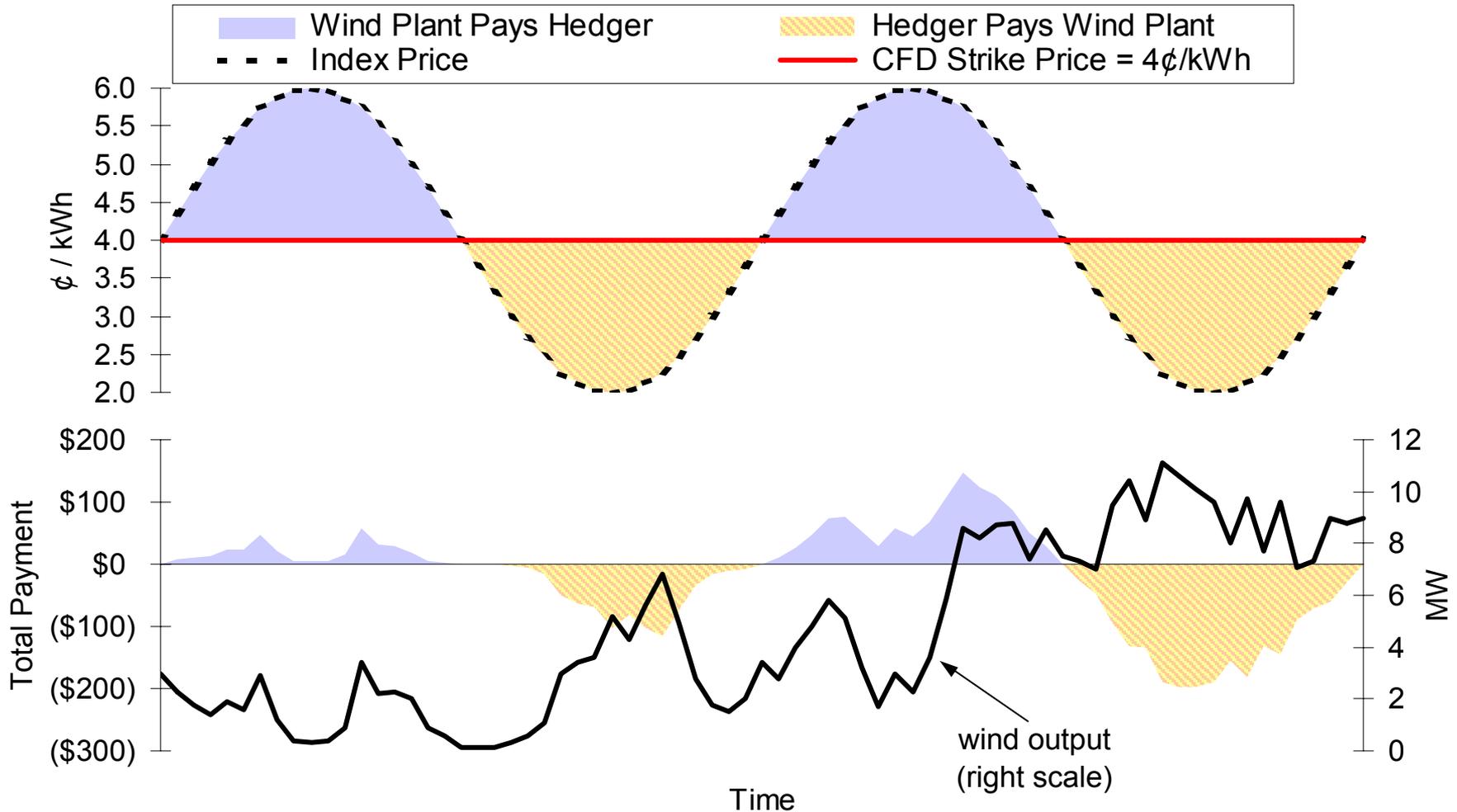
Competitive Markets:

- Little or no success offering a long-term hedge that benefits **both** wind generators & end-users...
- Green Mountain Energy
 - Breath Easy (CA) & Reliable Rate (TX)
 - 1-yr fixed price, achieved by *conventional* forwards and TRCs
- Community Energy
 - Has sold fixed-price wind TRCs up to 10 years
 - Exploring CFD hedge offering

Six Challenges to Wind Hedge Products

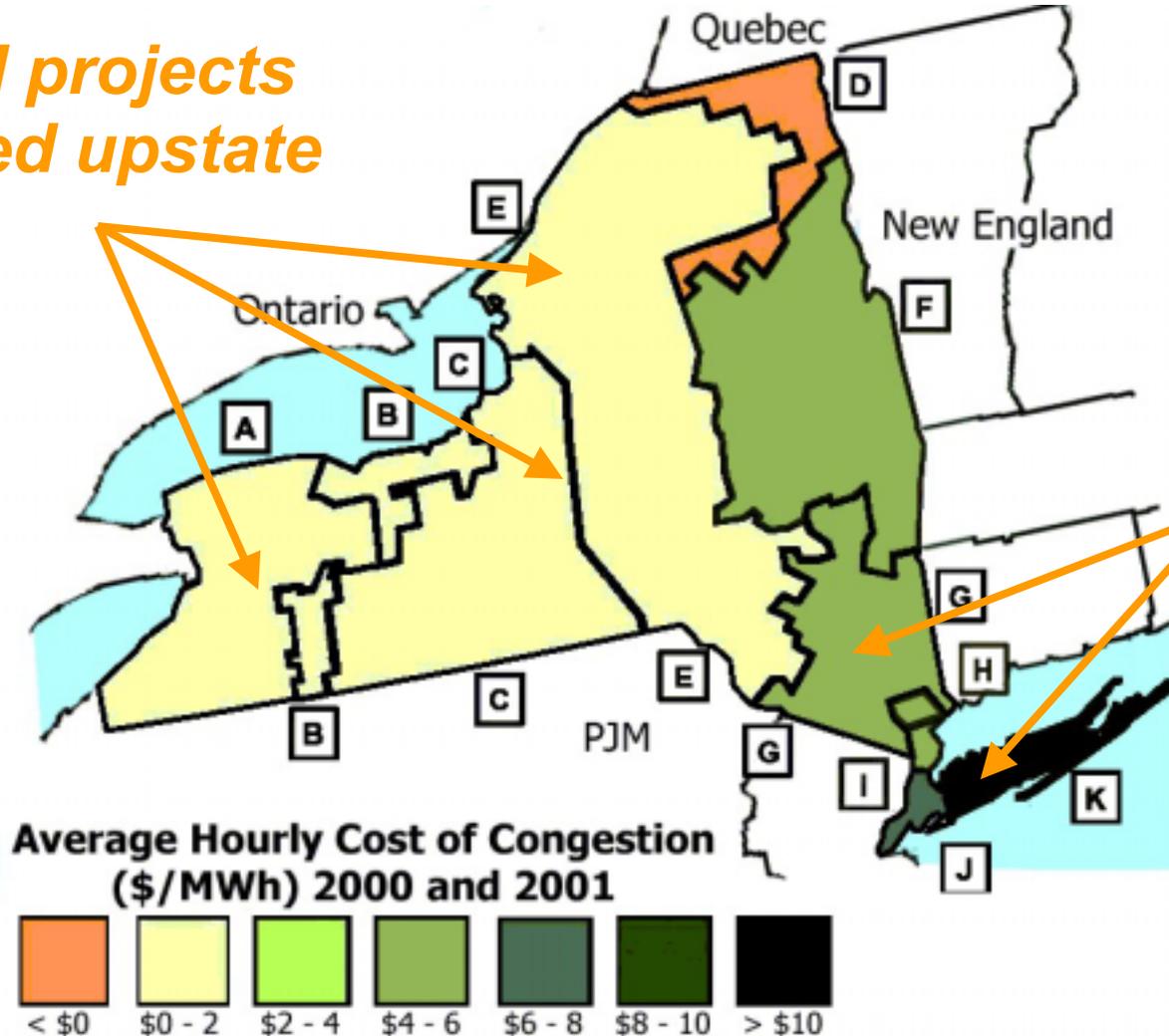
- 1) Customer resistance to long-term contracts
- 2) Customer resistance to switching suppliers
- 3) Credit risk
- 4) Lack of retail rate volatility
- 5) Wind intermittence and production/load mismatch**
- 6) Locational basis difference between wind generators and customers**

Intermittence Erodes Hedge Value



Congestion May Affect Hedge Value

Wind projects located upstate



Load (and high prices) located downstate

Analysis: How Good is a Wind Hedge?

Data & Assumptions:

- ⇒ 1 year of production data from Western NY wind plant
- ⇒ 32 months of NYISO spot prices (5/2000 – 12/2002)
- ⇒ Two different customer load shapes:
 - 1) High (85%) load factor (e.g., 3-shift industrial), no seasonality
 - 2) Aggregate NYISO load shape
- ⇒ Two different customer locations:
 - 1) Western NY (same zone as wind plant)
 - 2) New York City (transmission constrained zone)

Analysis: How Good is a Wind Hedge?

Five Scenarios (5/2000 – 12/2002):

1. **Spot (unhedged):** the “do nothing” approach
2. **100% wind hedge:** annual wind volume set to match annual usage
3. **50% wind hedge:** annual wind volume set to match 50% of annual usage
4. **Wind + summer forward:** wind volume sized to match winter usage, augmented with conventional “block forward” to match summer shortfall
5. **Conventional forward contract (no wind):** the benchmark – a conventional “block forward” sized to match the customer’s annual average load

Answer: Imperfect, yet Effective

Coefficient of Variation (stdev/avg) of Monthly Average Price

<i>Wind Plant Location:</i>	Western NY	Western NY	Western NY
<i>Customer Location:</i>	Western NY	Western NY	NYC
<i>CFD Indexed to:</i>	Western NY	Western NY	Western NY
<i>Customer Load Profile:</i>	"Flat"	NYISO Avg	"Flat"
<i>Spot (unhedged)</i>	19.2%	18.6%	20.2%
<i>Spot + 100% Wind Hedge</i>	9.0%	9.8%	12.3%
<i>Spot + 50% Wind Hedge</i>	9.8%	10.0%	N/A
<i>Spot + Wind + Summer Forward</i>	3.3%	3.9%	N/A
<i>Spot + Year-Round Forward</i>	1.8%	N/A	N/A

- Sizing the hedge to match winter load is a sound strategy
- Adding summer forward block hedge greatly enhances wind hedge
- CFD indexed to generator's LBMP provides reasonable hedge for customer (almost as good as if in the same zone!), perfect hedge for generator

Conclusions

Wind can provide a reasonably effective – though imperfect – retail electricity price hedge:

- May be particularly effective against:
 - 1) Broad market price changes (*e.g., caused by gas price trends or environmental compliance costs*)
 - 2) Price changes correlated with wind output (*e.g., in NY, winter price spikes*)
- Value increases over longer term (where few if any cost-effective alternatives exist)
- In NY, added hedge value may reduce “green premium” needed to support wind power